5.2 HOUSING DEMAND ANALYSIS

This chapter explores the housing demand from new employees and students at the ARC to understand whether there would be sufficient demand to justify the number and types of on-site housing units foreseen in Mitigation Measure SOCIO-1b. This analysis was conducted for NASA by Bay Area Economics (BAE).

A. Demand for Apartments and Townhomes

Bay Area Economics (BAE) developed a housing demand model to analyze the likely demand for housing that would arise from non-residential uses at ARC. The ARC housing demand model generated a preliminary estimate of demand for housing on-site at ARC with a breakdown of supportable rental rates. This information will be used by NASA planners and partners to refine proposed housing programs and ensure that on-site housing proposed under the NADP meets the needs of employees and students.

The model does not assume that all employee or student households are likely to demand housing at ARC. Instead, a predictable subset of households are predicted to form the core of demand. This preliminary demand is then translated into rents and unit types.

It should be noted that while this analysis is suited for planning purposes, more detailed demand and affordability studies will be required as specific housing programs are formulated by ARC Partners during NADP implementation.

1. Demand Model Methodology

The ARC housing demand model calculates demand for on-site units based on employee households. It treats student household demand separately, since student housing demand is highly specific to the university partner program.

The model generates estimates of employee on-site housing demand through the following steps:

- **Step 1: Identify Non-residential Land Uses.** The model uses the non-residential land uses proposed under Mitigated Alternative 5 in the

NADP EIS as the basis for employee projections and resulting housing demand estimates. These land uses include Office/R&D, Low Density Office/R&D, University Lab space, University Office, Public/Museum, Conference and Training Center, and Retail uses, and are listed in Table 5.2-1.

— **Step 2: Assign Census Industry Categories to Land Uses.** In order to predict the range of occupations at ARC, BAE identified a set of U.S. Census Industry Categories associated with each land use. This process is illustrated in Table 5.2-1. Each Census Industry Category encompasses one or more 3-digit SIC codes.

  For the Office/R&D and Low Density Office/R&D land use categories, BAE benchmarked Census Industry Categories against high-technology industry definitions employed in studies by Joint Venture Silicon Valley (JVSV), a non-profit economic development advocacy organization. Specifically, the model used a set of Census Industry Categories that match the "Semiconductors and Semiconductor Equipment," "Computer and Communication," and "Software" industry SIC codes, as defined by JVSV. For the Retail use, BAE assumed a set of Industry Categories that match NASA's preliminary plans for on-site retail development.

— **Step 3: Determine Percent Distribution of Occupation Categories for Each Land Use.** Using 1990 Census Public Use Microdata Sample (PUMS) data for the nine-county San Francisco Bay Area, BAE determined the percent distribution of occupation categories associated with each set of Census Industry Categories and each land use. Note that 2000 PUMS data were not available at the time of this writing. Table 5.2-1 contains this data.

— **Step 4: Formulate Employee Profiles within Each Occupation.** Again using 1990 PUMS data, BAE created a demographic profile of employee households for each NADP land use category and for each occupation. The median household income, housing tenure, housing type, percent of total households renting units in multifamily structures, and median number of rooms per unit were generated through custom, cross-tabulated

runs of PUMS data. The model inflated the reported 1989 median household income to 2002 dollars using an inflator derived from Claritas, Inc, a private data vendor. The results of this demographic analysis are presented in Table 5.2-2.

— **Step 5: Allocate NADP-Generated Employees to Occupation Categories.** To determine the total number of employees per NADP land use, BAE assumed industry standard employment densities (presented in Table 5.2-3 and consistent with the factors used for the NADP FEIS). These densities were applied to the land use program for Mitigated Alternative 5 (see Table 5.2-3). The occupation category distribution for each land use (extracted in Step 3) was then applied to the total number of employees. Table 5.2-4 summarizes the results of this step.

— **Step 6: Determine Housing Need and Demand.** The next step of the process, shown in Table 5.2-5, was to identify the number of employee households that would demand on-site housing. It was also assumed that households currently living in a single-family home or owning their residence would not choose to relocate to on-site housing. Given these assumptions, the percentage of households renting multifamily housing (extracted in Step 4) was applied to the total number of employees in each occupation category.

This process resulted in the preliminary calculation of the number of employees that might reside in ARC housing. This number of employees was then translated into households, assuming a minimum of one employee per household, per NASA's policy of maintaining at least one ARC employee in every unit.

As a final step, it was assumed that 50 percent of these households would actually choose to move to ARC. This assumption was based on results of a 1999 survey administered by the Presidio Trust to Presidio-based employees. The survey found that 57 percent of employees working at

Table 5.2-1: Occupational Categories Used for Analysis

NRP Land Use Category	Corresponding Census Industry Category and Associated SIC Codes	Occupation Categories	Distribution of Occupations in Industry Group (a)
Office/HD R&D LD R&D/Indust	Computers and related equipment (3571-3577) Machinery, except electrical, n.e.c. (355,356,358,359) Radio, TV, and communications equipment (365,366) Electrical machinery, equipment, and supplies, n.e.c. (361,362,364,367,369) Scientific and controlling instruments (381,382 except 3827) Computer and data processing services (737)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	44.6% 30.4% 1.0% 13.1% 10.9%
University: Academic Uses	Colleges and universities (822)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	61.3% 29.3% 5.8% 0.5% 1.6% 1.5%
University: Partner Uses	Computers and related equipment (3571-3577) Machinery, except electrical, n.e.c. (355,356,358,359) Radio, TV, and communications equipment (365,366) Electrical machinery, equipment, and supplies, n.e.c. (361,362,364,367,369) Scientific and controlling instruments (381,382 except 3827) Computer and data processing services (737)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	44.6% 30.4% 1.0% 13.1% 10.9%
Public/Museum	Museum, art galleries, and zoos (84)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	53.3% 30.2% 9.5% 3.5% 2.8% 0.7%
Conf/Training	Hotels and motels (701)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	18.0% 18.1% 56.5% 0.5% 2.8% 4.1%

Retail	Variety stores (533) Miscellaneous general merchandise stores (539) Retail bakeries (610) Eating and drinking places (58) Drug stores (591) Book and stationery stores (5942,5943) Gift, novelty, and souvenir shops (5947) Retail florists (5995) Miscellaneous retail stores (593,5948,5993-5995,5999)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	13.9% 29.5% 50.7% 0.2% 1.8% 3.9%
Recreation	PUMS data lacks a precise category for physical fitness facilities and similar recreational uses. Therefore, this analysis uses the industry categories and occupational distribution for Retail as a substitute for the Recreation industry.	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Precision Production, Craft, and Repair Operators, Fabricators, and Laborers	13.9% 29.5% 50.7% 0.2% 1.8% 3.9%
Support	Child day care services (835)	Managerial and Professional Specialty Technical, Sales, and Administrative Support Service Groundskeepers and Gardeners (b) Operators, Fabricators, and Laborers	45.0% 2.8% 51.9% 0.1% 0.2%

Notes:
(a) Total sample population includes employees in the nine-county Bay Area.
(b) Groundskeepers and Gardeners are included in the Farming, Forestry, and Fishing occupations.

Table 5.2-2: Potential Resident Profiles

Occupation Categories by Land Use	% of Employees Renting & Living in Multifamily Unit (a)	1989 Median Household Income	Inflated 2002 Median Household Income (b)	Median # of Rooms (c)
Office/HD R&D and LD R&D/Indust (d)				
Managerial and Professional Specialty	21.9%	$50,000	$88,500	4
Technical, Sales, and Administrative Support	27.9%	$41,100	$72,747	3
Service	33.6%	$34,500	$61,065	3
Precision Production, Craft, and Repair	26.5%	$38,000	$67,260	3
Operators, Fabricators, and Laborers	29.0%	$34,000	$60,180	4
University: Academic Uses				
Managerial and Professional Specialty	30.2%	$30,648	$54,247	4
Technical, Sales, and Administrative Support	33.4%	$28,950	$51,242	4
Service	33.6%	$29,736	$52,633	4
Groundskeepers and Gardeners (e)	47.1%	$37,000	$65,490	3
Precision Production, Craft, and Repair	23.6%	$41,900	$74,163	3
Operators, Fabricators, and Laborers	18.6%	$19,580	$34,657	4
University: Partner Uses				
Managerial and Professional Specialty	21.9%	$50,000	$88,500	4
Technical, Sales, and Administrative Support	27.9%	$41,100	$72,747	3
Service	33.6%	$34,500	$61,065	3
Precision Production, Craft, and Repair	26.5%	$38,000	$67,260	3
Operators, Fabricators, and Laborers	29.0%	$34,000	$60,180	4
Public/Museum				
Managerial and Professional Specialty	42.2%	$33,300	$58,941	3
Technical, Sales, and Administrative Support	47.6%	$25,637	$45,377	3
Service	41.3%	$19,200	$33,984	3
Groundskeepers and Gardeners	27.7%	$20,200	$35,754	3
Precision Production, Craft, and Repair (f)	0.0%	NA	NA	NA
Operators, Fabricators, and Laborers (f)	0.0%	NA	NA	NA
Conference/Training				
Managerial and Professional Specialty	38.0%	$38,741	$68,572	4
Technical, Sales, and Administrative Support	41.3%	$34,000	$60,180	4
Service	46.9%	$28,513	$50,468	3
Groundskeepers and Gardeners	24.9%	$29,740	$52,640	2
Precision Production, Craft, and Repair	28.8%	$38,600	$68,322	4
Operators, Fabricators, and Laborers	39.6%	$32,946	$58,314	3

Retail				
Managerial and Professional Specialty	30.2%	$35,980	$63,685	4
Technical, Sales, and Administrative Support	30.5%	$28,800	$50,976	4
Service	40.5%	$27,000	$47,790	3
Groundskeepers and Gardeners	40.2%	$36,000	$63,720	4
Precision Production, Craft, and Repair	38.4%	$28,000	$49,560	3
Operators, Fabricators, and Laborers	33.3%	$29,561	$52,323	3
Recreation (g)				
Managerial and Professional Specialty	30.2%	$35,980	$63,685	4
Technical, Sales, and Administrative Support	30.5%	$28,800	$50,976	4
Service	40.5%	$27,000	$47,790	3
Groundskeepers and Gardeners	40.2%	$36,000	$63,720	4
Precision Production, Craft, and Repair	38.4%	$28,000	$49,560	3
Operators, Fabricators, and Laborers	33.3%	$29,561	$52,323	3
Support				
Managerial and Professional Specialty	26.6%	$31,425	$55,622	4
Technical, Sales, and Administrative Support	27.5%	$35,962	$63,653	4
Service	26.9%	$20,900	$36,993	4
Groundskeepers and Gardeners (e)	100.0%	$37,000	$65,490	3
Operators, Fabricators, and Laborers	42.6%	$26,946	$47,694	4

Notes:

(a) Total sample population includes employees in the nine-county Bay Area.

(b) Incomes are from 1990 census inflated to 2002 dollars using an inflator derived from household income estimates by Claritas, Inc. Inflator: 1.77

(c) Rooms exclude bathrooms, porches, balconies, foyers, halls, and half-rooms.

(d) For the purposes of this analysis, no distinction is drawn between the personal and household characteristics of workers in the Office/HD R&D and LD R&D/Indust land uses.

(e) Due to small sample size, household income and room data for the Groundskeepers and Gardeners occupation within the University and Support industries are medians from all NRP industries combined.

(f) The PUMS data indicates that no Precision Production, Craft, and Repair or Operators, Fabricators, and Laborers employees in the Public/Museum industry live in rental multifamily housing in the Bay Area.

(g) Due to the lack of a census industry category that precisely identifies physical fitness centers and similar facilities, this analysis assumes the same housing pattern and income for Recreation employees as Retail employees.

(h) All income and room data are for persons living in rental multifamily housing. This is the population expected to demand housing at NRP.

Sources: 1990 U.S. Census of Population, Public Use Microdata Samples; Claritas, Inc.; Bay Area Economics, 2002.

Table 5.2-3: Employee Densities and Projections

EMPLOYMENT DENSITIES

Land Use	Density	Data Source
Office/HD R&D	279 gross square feet per employee	ITE code 750
LD R&D/Indust	405 gross square feet per employee	ITE code 760
University		
High Density Classroom	188 gross square feet per employee	Mission Bay EIR
Office	279 gross square feet per employee	ITE code 750
Low Density Classroom (a)	0 gross square feet per employee	Mission Bay EIR
Public/Museum (b)	115 staff per million annual visitors	USAF Museum - Dayton, OH
Conf/Training	1 employee per room	Fort Baker EIS
Retail		
Standard Retail	500 gross square feet per employee	ITE code 814
Other Support Space (c)	390 gross square feet per employee	See footnote (c)
Recreation (d)	625 gross square feet per employee	See footnote (d)
Support (e)	500 gross square feet per employee	See footnote (e)

EMPLOYMENT PROJECTIONS

Employee Generating Land Use	Proposed Space/Visitors/Rooms	Estimated Employment
Office/HD R&D (f)	948,645 gross square feet	2,358
LD R&D/Indust	12,000 gross square feet	30
University (g)	968,000 gross square feet	4,032
High Density Classroom	*484,000 gross square feet*	*2,574*
Office	*406,560 gross square feet*	*1,457*
Low Density Classroom	*77,440 gross square feet*	-
Public/Museum	1 million visitors	115
Conf/Training	250 rooms	250
Retail	100,000 gross square feet	214
Standard Retail	*75,000 gross square feet*	*150*
Other Support Space	*25,000 gross square feet*	*64*
Recreation	25,000 gross square feet	40
Support	25,000 gross square feet	50
	Total Employees	**7,088**

Notes:
(a) UCSF Campus Planning states that low-density classrooms do not generate significant employees.
(b) The complex and unique nature of the proposed museum space prohibits the use of square footage to project employees. Instead, the USAF Museum in Dayton, OH was used as a proxy to project daily staff. The USAF museum has a similar program and a comparable number of annual visitors. NASA estimates 1 million annual visitors to the museum space, while the USAF Museum sees 1.2 million visitors a year.

(c) Includes a variety of uses including student meeting rooms and other community services. Employee density is an average of Office/HD R&D and Standard Retail.
(d) Primarily includes health club facilities. Calls to comparable Bay Area health clubs were made to determine average employment density.
(e) Primarily includes child care space. Projection factor is function of legally mandated area per child (35 indoor sqft/child; another 15 sqft for non usable indoor space was added) and legally mandated staff to child ratio (average of 10 to 1).
(f) For Alternative Five only, 500,000 square feet of Office/HD R&D space is allocated to the ARC. Employee densities at ARC are expected to be 667 square feet per employee, leading to a total employee population of 750 at ARC. Other Office/HD R&D space at NRP will have 279 square feet per employee, leading to 1,608 employees in other NRP areas, and a total of 2,358 employees throughout NASA Ames.
(g) University Use Breakdown:

High Density Classroom	50%
Office	42%
Low Density Classroom	8%

Sources: Institute of Transportation Engineers, *Trip Generation, 5th ed.* ; University of California, San Francisco; National Park Service, *Fort Baker Final Environmental Impact Statement* , 1999; USAF Museum; National Child Care Information Center; Department of Social Services; Bay Area Economics, 2002.

Table 5.2-4: Employee Breakdown by Land Use

Occupations by Land Use	Distribution of Occupations in Industry Group (a)	Estimated Employment (b)	Number of Employees By Occupation
Office/HD R&D			
Managerial and Professional Specialty	44.6%	2,358	1,052
Technical, Sales, and Administrative Support	30.4%		717
Service	1.0%		24
Precision Production, Craft, and Repair	13.1%		309
Operators, Fabricators, and Laborers	10.9%		257
			2,358
LD R&D/Indust			
Managerial and Professional Specialty	44.6%	30	13
Technical, Sales, and Administrative Support	30.4%		9
Service	1.0%		0
Precision Production, Craft, and Repair	13.1%		4
Operators, Fabricators, and Laborers	10.9%		3
			30
University: Academic Uses			
Managerial and Professional Specialty	61.3%	3,667	2,248
Technical, Sales, and Administrative Support	29.3%		1,075
Service	5.8%		213
Groundskeepers and Gardeners	0.5%		18
Precision Production, Craft, and Repair	1.6%		59
Operators, Fabricators, and Laborers	1.5%		55
			3,667
University: Partner Uses (c)			
Managerial and Professional Specialty	44.6%	364	162
Technical, Sales, and Administrative Support	30.4%		111
Service	1.0%		4
Precision Production, Craft, and Repair	13.1%		48
Operators, Fabricators, and Laborers	10.9%		40
			364
Public/Museum			
Managerial and Professional Specialty	53.3%	115	61
Technical, Sales, and Administrative Support	30.2%		35
Service	9.5%		11
Groundskeepers and Gardeners	3.5%		4
Precision Production, Craft, and Repair	2.8%		3
Operators, Fabricators, and Laborers	0.7%		1
			115
Conference/Training			
Managerial and Professional Specialty	18.0%	250	45
Technical, Sales, and Administrative Support	18.1%		45
Service	56.5%		141
Groundskeepers and Gardeners	0.5%		1
Precision Production, Craft, and Repair	2.8%		7
Operators, Fabricators, and Laborers	4.1%		10
			250
Standard Retail			
Managerial and Professional Specialty	13.9%	150	21
Technical, Sales, and Administrative Support	29.5%		44
Service	50.7%		76
Groundskeepers and Gardeners	0.2%		0
Precision Production, Craft, and Repair	1.8%		3
Operators, Fabricators, and Laborers	3.9%		6
			150
Other Support Space (d)			
Managerial and Professional Specialty	13.9%	64	9
Technical, Sales, and Administrative Support	29.5%		19
Service	50.7%		33
Groundskeepers and Gardeners	0.2%		0
Precision Production, Craft, and Repair	1.8%		1
Operators, Fabricators, and Laborers	3.9%		3

			64
Recreation			
Managerial and Professional Specialty	13.9%	40	6
Technical, Sales, and Administrative Support	29.5%		12
Service	50.7%		20
Groundskeepers and Gardeners	0.2%		0
Precision Production, Craft, and Repair	1.8%		1
Operators, Fabricators, and Laborers	3.9%		2
			40
Support			
Managerial and Professional Specialty	45.0%	50	23
Technical, Sales, and Administrative Support	2.8%		1
Service	51.9%		26
Groundskeepers and Gardeners	0.1%		0
Operators, Fabricators, and Laborers	0.2%		0
			50

Notes:
(a) From Table 5.2-1.
(b) From Table 5.2-3.
(c) As in the EIS, analysis assumes that 25% of University Office space is dedicated to Partner uses.

(d) Assumes that employees in Other Support Space have identical occupational distribution as Standard Retail employees.

Sources: 1990 U.S. Census of Population, Public Use Microdata Samples; Bay Area Economics, 2002.

Table 5.2-5: Housing Need Projection

Occupations by Land Use	Number of Employees By Occupation (a)	% of Employees Renting & Living in Multifamily Unit (b)	Number of Employees Demanding Housing	Number of HH Demanding Housing (c)	Actual Units Demanded (d)
Office/HD R&D					
Managerial and Professional Specialty	1,052	21.9%	230	230	115
Technical, Sales, and Administrative Support	717	27.9%	200	200	100
Service	24	33.6%	8	8	4
Precision Production, Craft, and Repair	309	26.5%	82	82	41
Operators, Fabricators, and Laborers	257	29.0%	74	74	37
					297
LD R&D/Indust					
Managerial and Professional Specialty	13	21.9%	3	3	1
Technical, Sales, and Administrative Support	9	27.9%	3	3	1
Service	0	33.6%	0	0	0
Precision Production, Craft, and Repair	4	26.5%	1	1	1
Operators, Fabricators, and Laborers	3	29.0%	1	1	0
					4
University: Academic Uses					
Managerial and Professional Specialty	2,248	30.2%	679	679	339
Technical, Sales, and Administrative Support	1,075	33.4%	359	359	180
Service	213	33.6%	71	71	36
Groundskeepers and Gardeners	18	47.1%	9	9	4
Precision Production, Craft, and Repair	59	23.6%	14	14	7
Operators, Fabricators, and Laborers	55	18.6%	10	10	5
					571
University: Partner Uses					
Managerial and Professional Specialty	162	21.9%	36	36	18
Technical, Sales, and Administrative Support	111	27.9%	31	31	15
Service	4	33.6%	1	1	1
Precision Production, Craft, and Repair	48	26.5%	13	13	6
Operators, Fabricators, and Laborers	40	29.0%	11	11	6
					46
Public/Museum					
Managerial and Professional Specialty	61	42.2%	26	26	13
Technical, Sales, and Administrative Support	35	47.6%	17	17	8
Service	11	41.3%	5	5	2
Groundskeepers and Gardeners	4	27.7%	1	1	1
Precision Production, Craft, and Repair	3	0.0%	-	0	0
Operators, Fabricators, and Laborers	1	0.0%	-	0	0
					24

Conference/Training					
Managerial and Professional Specialty	45	38.0%	17	17	9
Technical, Sales, and Administrative Support	45	41.3%	19	19	9
Service	141	46.9%	66	66	33
Groundskeepers and Gardeners	1	24.9%	0	0	0
Precision Production, Craft, and Repair	7	28.8%	2	2	1
Operators, Fabricators, and Laborers	10	39.6%	4	4	2
					54
Standard Retail					
Managerial and Professional Specialty	21	30.2%	6	6	3
Technical, Sales, and Administrative Support	44	30.5%	13	13	7
Service	76	40.5%	31	31	15
Groundskeepers and Gardeners	0	40.2%	0	0	0
Precision Production, Craft, and Repair	3	38.4%	1	1	1
Operators, Fabricators, and Laborers	6	33.3%	2	2	1
					27
Other Support Space					
Managerial and Professional Specialty	9	30.2%	3	3	1
Technical, Sales, and Administrative Support	19	30.5%	6	6	3
Service	33	40.5%	13	13	7
Groundskeepers and Gardeners	0	40.2%	0	0	0
Precision Production, Craft, and Repair	1	38.4%	0	0	0
Operators, Fabricators, and Laborers	3	33.3%	1	1	0
					11
Recreation					
Managerial and Professional Specialty	6	30.2%	2	2	1
Technical, Sales, and Administrative Support	12	30.5%	4	4	2
Service	20	40.5%	8	8	4
Groundskeepers and Gardeners	0	40.2%	0	0	0
Precision Production, Craft, and Repair	1	38.4%	0	0	0
Operators, Fabricators, and Laborers	2	33.3%	1	1	0
					7
Support					
Managerial and Professional Specialty	23	26.6%	6	6	3
Technical, Sales, and Administrative Support	1	27.5%	0	0	0
Service	26	26.9%	7	7	3
Groundskeepers and Gardeners	0	100.0%	0	0	0
Operators, Fabricators, and Laborers	0	42.6%	0	0	0
					7
				Total Units Demanded	**1,048**

Notes:
(a) From Table 5.2-4.
(b) From Table 5.2-2.
(c) Number of Households = Number of Employees/Workers per Household.
Workers per Household: 1 per NASA policy requiring at least one NRP employee per unit.
(d) This analysis assumes that 50 percent of new employees currently renting multifamily units would choose to relocate to NRP housing. This assumption is based on results of a 1999 survey of Presidio Trust employees, where 57 percent of Trust employees who rent stated they would choose to relocate to the Presidio upon buildout. This analysis adopts a more

demand from *existing* employees, and only uses the Presidio Trust data as a guide in determining *new* employees' desire to relocate to ARC.

Sources: 1990 U.S. Census of Population, Public Use Microdata Samples; Presidio Trust; Bay Area Economics, 2002.

the Presidio would choose to relocate to new housing at the Presidio. To be conservative, this model only assumed 50 percent of households would choose to relocate to ARC.[1] This model is also conservative in that it only estimates housing demand generated by new NADP employees. Additional demand may also be generated by existing Ames Campus and Eastside/Airfield employees. In fact, the traffic impact analysis presented in Section 5.3 suggests that a portion of existing employees may relocate to on-site housing.

The 50 percent assumption is also justified by the fact that ARC housing would serve on-site employees' specific needs in terms of unit size and rent level. In contrast, the Presidio housing program was constrained by existing structures, and therefore had a limited range of unit types. Furthermore, the Presidio Trust adopted a more aggressive rent schedule than is proposed for ARC. Presidio survey respondents were aware of both these factors. While ARC lacks access to some neighborhood serving retail, such as a grocery store, it does offer a number of amenities including views of the Baylands, on-site child care, shuttle service to employment, and on-site recreational and educational facilities, all of which would support a 50 percent relocation assumption.

— **Step 7: Determine Affordable Rents.** To calculate affordable rents, BAE assumed that households would not spend more than 35 percent of gross household income on housing costs (excluding utilities). Traditional affordable housing demand analyses frequently use a 30 percent income-to-rent ratio, but BAE has employed private sector tenant screening criteria for this analysis. These private sector standards range from 35 to 40 percent of gross income to rent. This analysis is presented in Table 5.2-6, and the complete model results are summarized in Table 5.2-7. Note that rent levels will be adjusted as necessary to reflect market

[1] Although the Presidio Trust data applies to existing employees' desire to relocate to on-site housing, it is used here as a guide in determining new NADP employees' willingness to reside at ARC. As stated above, this housing demand analysis does not account for demand from existing ARC employees.

conditions upon buildout and on-site employee needs. The rents shown in the housing model and discussed here should be considered preliminary estimates.

2. Model Results

Based upon the methodology and assumptions of the ARC housing demand model, BAE obtained the following results:

- For planning purposes, there is support for approximately 1,048 multifamily units targeted to NRP employee households. Additional units may be demanded by existing Ames Campus and Eastside/Airfield employees.
- Mitigated Alternative 5 plans the development of 1,120 units at Bay View. These units would house approximately 15 percent of total new employee households generated by Mitigated Alternative 5, assuming one employee per household.
- Approximately 25 percent of total demand would be for higher-end apartments or moderately priced townhomes (i.e. monthly rents from$2,000 to $2,400), assuming no more than 35 percent of an employee household's gross income is spent on housing. This percentage translates into approximately 270 units. The conceptual land use plan in Chapter 5.1 includes 250 units of this type, which would be supportable according to these calculations.
- Using the same income-to-rent ratio, approximately 13 percent of units, or 134 of the total proposed units under Mitigation Measure SOCIO 1-b, would be priced within $1,600 and $2,000 per month.
- Using the same income-to-rent ratio, over 57 percent of demand by employee households would be for units priced between $1,400 and $1,600 per month. This translates into approximately 602 of the 1,050 units that could be supported.

Table 5.2-6: Housing Price and Affordability

Occupations by Land Use	Inflated 2002 Median Household Income (a)	Affordable Gross Monthly Rent (b)	Actual Units Demanded (c)
Office/HD R&D			
Managerial and Professional Specialty	$88,500	$2,581	115
Technical, Sales, and Administrative Support	$72,747	$2,122	100
Service	$61,065	$1,781	4
Precision Production, Craft, and Repair	$67,260	$1,962	41
Operators, Fabricators, and Laborers	$60,180	$1,755	37
LD R&D/Indust			
Managerial and Professional Specialty	$88,500	$2,581	1
Technical, Sales, and Administrative Support	$72,747	$2,122	1
Service	$61,065	$1,781	0
Precision Production, Craft, and Repair	$67,260	$1,962	1
Operators, Fabricators, and Laborers	$60,180	$1,755	0
University: Academic Uses			
Managerial and Professional Specialty	$54,247	$1,582	339
Technical, Sales, and Administrative Support	$51,242	$1,495	180
Service	$52,633	$1,535	36
Groundskeepers and Gardeners	$65,490	$1,910	4
Precision Production, Craft, and Repair	$74,163	$2,163	7
Operators, Fabricators, and Laborers	$34,657	$1,011	5
University: Partner Uses (c)			
Managerial and Professional Specialty	$88,500	$2,581	18
Technical, Sales, and Administrative Support	$72,747	$2,122	15
Service	$61,065	$1,781	1
Precision Production, Craft, and Repair	$67,260	$1,962	6
Operators, Fabricators, and Laborers	$60,180	$1,755	6
Public/Museum			
Managerial and Professional Specialty	$58,941	$1,719	13
Technical, Sales, and Administrative Support	$45,377	$1,324	8
Service	$33,984	$991	2
Groundskeepers and Gardeners	$35,754	$1,043	1
Precision Production, Craft, and Repair	NA	NA	0
Operators, Fabricators, and Laborers	NA	NA	0
Conference/Training			
Managerial and Professional Specialty	$68,572	$2,000	9
Technical, Sales, and Administrative Support	$60,180	$1,755	9
Service	$50,468	$1,472	33
Groundskeepers and Gardeners	$52,640	$1,535	0
Precision Production, Craft, and Repair	$68,322	$1,993	1
Operators, Fabricators, and Laborers	$58,314	$1,701	2
Standard Retail			
Managerial and Professional Specialty	$63,685	$1,857	3
Technical, Sales, and Administrative Support	$50,976	$1,487	7
Service	$47,790	$1,394	15
Groundskeepers and Gardeners	$63,720	$1,859	0
Precision Production, Craft, and Repair	$49,560	$1,446	1
Operators, Fabricators, and Laborers	$52,323	$1,526	1

Other Support Space			
Managerial and Professional Specialty	$63,685	$1,857	1
Technical, Sales, and Administrative Support	$50,976	$1,487	3
Service	$47,790	$1,394	7
Groundskeepers and Gardeners	$63,720	$1,859	0
Precision Production, Craft, and Repair	$49,560	$1,446	0
Operators, Fabricators, and Laborers	$52,323	$1,526	0
Recreation			
Managerial and Professional Specialty	$63,685	$1,857	1
Technical, Sales, and Administrative Support	$50,976	$1,487	2
Service	$47,790	$1,394	4
Groundskeepers and Gardeners	$63,720	$1,859	0
Precision Production, Craft, and Repair	$49,560	$1,446	0
Operators, Fabricators, and Laborers	$52,323	$1,526	0
Support			
Managerial and Professional Specialty	$55,622	$1,622	3
Technical, Sales, and Administrative Support	$63,653	$1,857	0
Service	$36,993	$1,079	3
Groundskeepers and Gardeners	$65,490	$1,910	0
Operators, Fabricators, and Laborers	$47,694	$1,391	0

Notes:
(a) From Table 5.2-2.
(b) Affordable gross monthly rent is considered to be 35% of household income, inclusive of utilities.
(c) From Table 5.2-5.

Sources: 1990 U.S. Census of Population, Public Use Microdata Samples; Bay Area Economics, 2002.

Table 5.2-7: Housing Demand Summary

Affordable Gross Monthly Rent Range (a)	Number of Units Demanded (b)	Percent of Total
$2,200 to $2,400	134	12.8%
$2,000 to $2,200	132	12.6%
$1,800 to $2,000	59	5.6%
$1,600 to $1,800	75	7.2%
$1,400 to $1,600	602	57.4%
$1,000 to $1,400	44	4.2%
$800 to $1,000	2	0.2%
Total	**1,048**	**100.0%**
Median Gross Monthly Rent	**$1,755**	
Average Gross Monthly Rent	**$1,711**	

Notes:
(a) Ranges from Table 5.2-6.
(b) Units summed from Table 5.2-6.

Sources: Bay Area Economics, 2002.

— At least 10 percent of total units would be priced below $1,400 per month to ensure that employees in lower paying occupations have an opportunity to be housed on-site. This percent is approximately the same as would typically be found in surrounding communities. Mitigation Measure SOCIO-1d states that NASA would ensure that at least 10 percent of on-site housing is affordable to low income households.

  NASA may have to explore discounted rents to accommodate employee households at this lower end of the affordable rent range. The degree of rent discounts will depend on construction costs, cost of financing, and the overall market rents at the time of project development. BAE recommends further analysis of this program option once more information is available from NASA's ARC planning partners.

3. Market Rate Rents and Unit Sizes

The housing demand model predicts that rents that would be affordable to NRP employee households are slightly higher than average rents reported for Mountain View. The projected average monthly rent for ARC housing units is $1,711, compared to an average rent of $1,555 for Mountain View apartments in the fourth quarter of 2001. However, the higher rents for on-site housing would be justified by the fact that units would be larger on the average at ARC. NASA is assuming an average unit size of 1,300 square feet for townhomes and 1,000 for apartments, with two to three bedrooms per unit. In comparison, the average two to three-bedroom unit in the City of Mountain View is approximately 1,004 square feet.

Table 5.2-8 contains these data. Rent and unit size data for the City of Mountain View were obtained from RealFacts, a commercial data vendor.

4. Marketability of Proposed Housing

In response to the NADP Draft Environmental Impact Statement, commentors expressed concern over the marketability of high-density housing such as that proposed for the Bay View area. Housing at Bay View is expected to be 48 units per gross acre. BAE researched projects currently under

development in Sunnyvale and Mountain View to demonstrate the private sector's willingness to provide high-density housing and show that high-density housing at Bay View would have market support. In Sunnyvale a 124-unit apartment complex has been approved at 395 East Evelyn Avenue, at 41 units to the acre. Another approved project at 321 East Washington Avenue has densities of 48 units to the acre. In Mountain View, a 211-unit residential project at 2400 El Camino Real has 48 units to the acre. Absorption of these units depends largely on regional real estate market cycles. However, local developers report that Silicon Valley apartment developers are increasingly developing high-density projects due to high land values and successful marketing of this product type. One developer described high-density housing as "very marketable" and noted that some developers have built up to eight-story apartment projects in Silicon Valley.[2]

In addition, a residential project at Bay View would have the market advantage of views of the bay lands, proximity and shuttle service to employment at ARC, access to on-site child care, and on-site recreational and educational facilities.

B. Demand for Student Housing

The housing foreseen under Mitigation Measure SOCIO-1 and outlined in Section 5.1 would include 810 student apartments and dormitories. Assuming two persons per unit, approximately 1,560 students could be accommodated in the ARC. This section considers whether there would be adequate demand for this student housing.

NASA's university partners (University of California, San Jose State University and Carnegie Mellon University) have submitted program plans to NASA indicating a total of approximately 3,000 undergraduate, graduate,

[2]Interview with Miles Huber, Archstone Communities, 4/29/02.

continuing education and extension students that would be accommodated under ARC development. This identified pool of students represents the total universe of demand for student housing at ARC.

The proposed housing supply for 1,560 students would house 52 percent of the projected student population of approximately 3,000 students. As a benchmark, the University of California at Merced campus, currently under development, expects to house 50 percent of its student population on campus. Stanford University houses approximately 100 percent of its undergraduate population and 52 percent of its graduate student population. These figures suggests that the NRP plans for student housing reflect an adequate and reasonable estimation of demand. The historically high cost of housing in Santa Clara County also suggests a strong demand for on site student housing.

Table 5.2-8: Overview of Mountain View Apartment Market

CURRENT MARKET DATA

Unit Type	Number	Percent of Total	Avg. Sq. Ft.	Avg. Rent (a)	Avg. Rent/Sq. Ft.
0/1	861	11.40%	504	$1,343	$2.67
1 BR/1 BA	3,445	45.50%	698	$1,406	$2.01
2 BR/1 BA	1,140	15.10%	892	$1,519	$1.70
2 BR/2 BA	1,462	19.30%	1,023	$1,858	$1.82
2 BR Twnhse	214	2.80%	1,074	$1,808	$1.68
3 BR/2 BA	424	5.60%	1,191	$2,070	$1.74
3 BR Twnhse	26	30.00%	1,300	$2,400	$1.85
Totals	7,572	100.0%	808	$1,555	$1.92

RENT TRENDS

	Quarterly Rent Trend		Annual Rent Trend
2000Q1	$1,536	**1994**	$898
2000Q2	$1,790	**1995**	$945
2000Q3	$1,997	**1996**	$1,107
2000Q4	$2,052	**1997**	$1,259
2001Q1	$2,066	**1998**	$1,389
2001Q2	$1,862	**1999**	$1,453
2001Q3	$1,757	**2000**	$1,837
2001Q4	$1,555	**2001**	$1,810
4 Period +/-	-24.2%		43.8%

VACANCY TRENDS

	Vacancy Rate
1994	4.1%
1995	1.2%
1996	2.1%
1997	2.8%
1998	4.2%
1999	3.1%
2000	1.1%
2001	7.1%

Notes:
(a) Rents as of 4Q 2001.

Sources: RealFacts, Inc.; Bay Area Economics, 2002.